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Changes in rural poverty in Perú 2004–2012

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Abstract This paper disaggregates the various sources of rural income growth in Peru between 2004 and 2012 and shows that about 80% of the increase came from rising earnings and only 15% from transfer programs. This increase in rural earnings was not led by agriculture. It was mainly because of a general rise in wages across industrial and services activities within the rural population, coupled with a massive movement of the better educated from the rural to the urban areas of the Sierra and Selva. Rapid overall growth rate of the economy permitted an increase in average wages both in the urban receiving areas and for the smaller labor force left behind in the rural sector. In analyzing changes in poverty over time, it is important to distinguish what happens to a given age cohort from changes in the income of different deciles of the distribution. The paper creates a quasi-panel by equivalent cohort. The panel shows that first, there was tremendous progress made in rural poverty reduction among those who were poor in 2004. That is true in both the rural and urban sectors. There were 6.3 million rural poor in 2004. 46% of them or almost three million got out of poverty over the period. Second, it is instructive that 62% of the group that got out of poverty stayed in the rural sector. In other words, almost two thirds of rural poverty reduction was due to increases in rural family income not rural–urban migration. Third, among the rural poor, it was the young who migrated—64% of total rural–urban migration of the poor came from the 0–25 cohort even though it comprised less than 60% of the rural poverty population in 2004.

Keywords Peru · Rural poverty reduction · Rural urban migration · Mobility · Equivalent cohorts

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1 Introduction

The period since year 2000 has seen remarkable world-wide progress in poverty reduction. But most of this progress is urban. Much less progress has been attained in the rural sector where about 45% of the rural population is still poor. Reaching the MDG goal of halving rural poverty rates over the 1990–2015 period has not been met. Rapid growth has helped but most poverty reduction has been urban, not rural. Devising a strategy to reduce rural poverty is one of the most significant challenges facing development experts.

Peru is both a good example of the problem and a guide to possible solutions. It has always had a rural poverty problem. Even during the decades when Peru grew rapidly, most of the progress was either in the urban sector or on the coast. Over the 8-year period 2004–2012, there was a boom in Peru. Per capita income increased by over 5.5% per year and total poverty was cut by almost 60%.[1] But over two thirds of that reduction was urban. Urban poverty fell from 48% of the urban population in 2004 to only 16% 8 years later. Rural poverty rates fell too, but not nearly as fast. That would not present too much of a problem if the rural poverty population was small. But it is not. It comprised 47% of all the poverty in the country in 2012, and was concentrated in the high Andes where most of the rural population lives. This has always presented Peru with a vexing political problem, increasing the level of inequality and exacerbating the ethnic divisions within the country.

Thanks to the extended economic boom of the last 10 years, Peru is well on its way to reducing urban poverty to first world levels. Even though rural poverty has not fallen nearly as quickly and has shown itself to be relatively insensitive to government efforts at poverty reduction, still Peru is one of only ten countries in the entire world for which we have comparable data where rural poverty has fallen by at least 3% per year since the millennium (Inchauste et al. 2012). Thus, Peru is both a good example of the rural poverty problem, and a possible guide to a successful strategy for rural poverty reduction. No one should imagine that reducing rural poverty in Peru was going to be easy. The amount of arable land per capita in the Andes is small, the climate is dry and cold and most of the rural population lives at least 10,000 feet above sea level (Morley 2011). Yet Peru despite these structural handicaps managed to reduce the rural poverty rate from 85% in 2004 to 55% 8 years later. How did they do this? That is the central question we want to address in this paper.[2] What role was played by rapid growth, sectoral growth in agriculture, rural–urban migration, government transfers, and improvements in education? What lessons can we learn from the Peruvian experience that can be transferred to other countries with a significant rural poverty problem? We will attempt to answer these questions by means of an analysis of two recent living standards measurement

[1] For an analysis of the previous decade see Escobal and Ponce (2011).

[2] For a case study of various programs to increase agricultural incomes and productivity in the Andes, see Morley (2009).

surveys, one in 2004 adjusted by updated population weights and a second in 2012.[3] These are big comparable national surveys from which the statistics on poverty in this paper are drawn.

In section two of the paper we present an overview of the evidence from the surveys and disaggregate changes in family income over time. We calculate the fraction of the total change that was due to transfers, demographic factors and earned income. We show that far and away the largest factor for rural families was the growth in earned income. It came mainly from wages and mainly from employment growth in industrial or service sector activities, not from agriculture.

In section three, we have found it informative to disaggregate the 2012 survey by what we will call equivalent cohorts by which we mean the age groups of 2004 as they appear 8 years later in 2012. Ideally we would like to be able to follow individuals over time using panel data. Unfortunately we do not have panel data. But the equivalent cohort treatment is what one could call a quasi-panel since it follows a given age cohort over time, using surveys that are both large and representative. Their use gives a significantly different picture of poverty reduction or rural–urban migration than the usual treatment.

The equivalent cohort approach permits us to construct mobility matrices in section four of the paper. The first such matrix shows the movement of the 2004 population between the rural and urban areas and between the Sierra-Selva and the Coastal regions. It shows us how the rural population of the Sierra has been drawn to the urban sector, particularly within the Sierra itself. We also construct a second mobility matrix, this one by poverty, sector and cohort. This matrix quantifies the significant upward mobility of the 2004 rural and urban poverty population and gives a better understanding of the sources of rural poverty reduction by age and sector. It also quantifies an important distinction between poverty reduction and upward mobility as a measure of progress.

Section five summarizes our findings and concludes with policy implications that can be drawn from the Peruvian case.

2 An overview of the evidence

Table 1 gives the raw data from the household surveys upon which all of our analysis will be based.[4] As the reader can see, there has been an impressive amount of poverty reduction in Peru since 2004. Most of it is urban, but even so rural poverty fell by at least 2.5 million, and the rate of extreme poverty fell over 50%. These are impressive reductions by any measure, and our interest is going to be to shed light on the factors that led to these results.

[3] The data for these comparisons come from the surveys made available on the INEI website and analyzed in this paper. The 2004 survey has been adjusted using the updated population weights from the 2007 Demographic Census.

[4] Peru has an annual living standards measurement survey covering around 25,000 households and 100,000 individuals. The survey includes detailed information by individual on personal characteristics, family status, sources of income and expenditures all subdivided by department and region. See http://www.INEI.gob.pe.

Table 1 Poverty data for 2004–2012 in Peru by urban–rural

	Rural and urban poverty shares		Population shares	Poverty incidence		INEI
	Extreme	Total		Extreme	Total	
2004						
Rural	0.72	0.39	0.26	0.43	0.85	0.83
Urban	0.28	0.61	0.74	0.06	0.48	0.48
National				0.16	0.57	
2012						
Rural	0.76	0.47	0.22	0.21	0.55	0.53
Urban	0.24	0.53	0.78	0.02	0.18	0.17
National				0.06	0.26	

Source: All the data in this paper come from INEI household surveys using the updated population weights from the 2007 Demographic Census. Poverty estimates are based on family consumption per capita compared to official regional poverty lines. Because we want to disaggregate the data by age and place of residence our poverty estimates are slightly different than the official poverty figures published by INEI and show in the last column of the table. Estimates are based on family income per capita

2.1 The decomposition of changes in family income over time

In this paper we are going to disaggregate the changes over time in reported income as well as track what happened to different cohorts of the population (Azevedo et al. 2014). To do that we use two detailed household surveys, one from 2004 and the other from 2012. The original 2004 survey was based on population weights from an early population census. These weights were updated using data from the 2007 demographic census. The Peruvian Census Bureau (INEI) then updated the 2004 survey. This is the 2004 base that we used to get comparable statistics for 2004 and 2012. Our poverty estimates are slightly different from those published by INEI because some respondents in either of the two surveys did not report either age, income or place of residence. This underreporting is small enough that we are confident that the changes we will analyze here are representative of the entire universe of households in Peru.

Leaving the consumption–income relationship aside, we now concentrate on the determinants of changes in family income per capita.[5] Households are the main redistributive instrument in all societies. They consolidate earnings by a subset of family members and then distribute the total of earned income among all the members of the family. The economy affects the distribution indirectly, through its effects on earners. But demographic factors play a role too. Obviously the ratio of income recipients to dependents or to the total size of the family is an important determinant of how much money will be available to distribute among all family members.

The household surveys give us an estimate of household income and the population receiving that income for 2004 and 2012 in both the rural and urban

[5] We switch from expenditure to income here so that we can decompose the changes in income upon which changes in expenditure must be based.

sectors. Household income is split into earnings, transfers and other. Since we are interested in the effect of economic growth in general and agriculture in particular, it is useful to separate the part directly affected by the market from the part coming from transfers and other (see Table 2). Earnings is defined as the sum of all income from labor, either direct payments, payments in kind from primary or secondary occupations or earnings from self-employment in agriculture or the informal sector. Transfers include public and private transfers both domestic and foreign. The category other includes all other sources of revenue. For the rural area as a whole, between 2004 and 2012 reported per capita income increased from 1430 soles to 3170 soles and the population shrank by 9%. The table tells us that 80% or 1392 of the observed change of 1740 soles came from changes in the earnings component and only 20% from the two non-earned income components. Increases in non-earned income are not the main reason for rural poverty reduction. The main impetus came from the increase in earned income.

We now want to look behind these aggregate results. Both earned and non-earned income can be further subdivided into demographic and income factors. There were three important demographic shifts going on between 2004 and 2012 each of which could have an effect on the change on income per capita. First there was outmigration from the rural sector. Total rural population shrank from 7.8 million to

Table 2 Sources of monthly income (per capita)

	2004				2012			
	Earned	Transfers	Other	Total income	Earned	Transfers	Other	Total income
Urban	3392	494	1164	5050	6639	663	2032	9334
Rural	*977*	75	378	*1430*	*2369*	*171*	*630*	*3170*
	Growth rate of income (2012/2004)-1				Absolute change in income			
	Earned	Transfers	Other	Total income	Earned	Transfers	Other	Total income
Urban	1.25	0.54	1.00	1.12	3247	169	868	4284
Rural	1.21	1.08	0.52	1.02	*1392*	96	252	1740

	Hypothetical income with constant pop.			Change with constant population		
	Earned	Unearned income	Total income	Earned	Unearned	Total
Urban	7617	3092	10,708	4225	1434	5659
Rural	*2157*	729	2886	*1180*	276	1456

	Hypothetical income with just migration			Change with just migration		
	Earned	Unearned income	Total income	Earned	Unearned	Total
Urban	2956	1445	4401	−435	−213	−648
Rural	1073	497	1571	96	45	141

Source: author's worksheets based on the INEI household surveys. Data are in soles per month. Italicized entries are mentioned in the text explanation of this table

7.1 million. Second, the number of households and the amount of employment increased and third, there were important changes in the dependency ratio or the number of family members per earner or per family. With respect to earned income a part of the observed change must have been due to changes in average earnings per labor force participant and part to the change in the number of earners. In Table 2, we show our estimate of the decomposition of all these changes.

Consider now the earnings component of household income per capita in the rural sector.[6] This is the part that is directly affected by conditions in the rural labor market. Here earnings go to individuals to be later lumped together with other sources of family income. But since we are interested in labor income across individuals grouped together into families there are three separate effects to consider average wages, employment and demographic factors. It turns out that there has been a large decrease in both average family size and in the ratio of family members to earners (the dependency ratio).[7] That is true for the country as a whole and for the Sierra-Selva considered separately. Average family size has fallen from 4.45 to 3.9 between 2004 and 2012. The national dependency ratio has fallen from 2.15 to 1.74, and the decline can be seen in all our rural and urban subsamples and for the Sierra-Selva subsample. In 2004, the average adult had to support over two dependents, but only 1.7, 8 years later. Even if there had been no progress in the economy over the period, or if average wages had been stagnant, this change would permit an increase in per capita consumption simply because more people were working or receiving pensions and transfers and average family sizes had dropped.

How much of the change in total labor income came from changes in income received and how much from changes in the population receiving income? The data permit us to calculate total household income from labor earnings, transfers and pensions. Following our previous thought experiment, we construct several hypothetical 2012 earnings per capita. First hold the population constant at the 2004 level. Then as shown by the italicized entry in Table 2 the hypothetical earnings per capita in the rural sector is total rural earnings in 2012 divided by the rural population of 2004 or 2157 soles. That is what monthly labor income per capita would have been if there had been the observed rate of growth of employment and wages with a constant population. But actual rural earned income per capita was 2369 soles (see Table 2). At this point we cannot disaggregate the change in income into changes in employment and changes in the average wage rate. But we see that had the rural population been constant, income would have risen from 977 to 2157 soles. Instead it rose to 2369 soles because the rural population fell. Since the observed change in earned income per capita was 1392 soles, we estimate that 85% (1180/1392) came from the growth in rural earned income and 15% or 212 came from the fall in the rural population.

[6] Note that the estimates here are national. Most rural poverty in Peru is in the Sierra-Selva region which we track using mobility matrices later in the paper.

[7] Note that this measure of dependency is derived from the household files which have a variable called number of receivers of income. That includes people receiving pensions and transfers, not just earned income. In other words, those receiving retirement income and or transfers will be counted as income recipients and introduced into the calculation of the dependency ratio shown in the table.

Consider next non-earned rural income. If we assume that non-labor income is independent of demographic factors, then what is relevant is simply total non-labor income distributed across the observed population. For simplicity and as a first approximation assume that the 2012 amount of transfers and other income is invariant relative to the number of recipients. Then the effect of demographic factors is what per capita transfers in 2012 would have been with the base period population. Actual non-earned income per capita in 2012 was 801 soles. (171 + 630) Had the rural population remained at the 2004 level, non-earned income would have been 729 soles.[8] In other words outmigration increased per capita non-earned income by 72 soles. To put this another way, the increase in non-earned income to the base period population was 276 soles. Since the observed change in non-earned income per capita between 2004 and 2012 was 348 soles, we estimate that 21% of that change came from a reduction in the rural population (72/348) and 79% from the direct increase in transfers and other income received by the remaining rural population (276/348).

The important point here is that most of the observed increase in rural income per capita came from the growth in labor income rather than demographic factors. One might have imagined that the outmigration and the reduction in the dependency rate would be equally important, but they are not, at least not directly.[9] Altogether gains in labor income contributed 68% of the observed increase in rural income per capita from all sources while the increase in unearned income contributed 16% and the reduction of rural population an additional 16%.[10] That means that most of the story of poverty reduction and increases in rural income in the rural sector in Peru were the result of increases in labor income in the countryside, rather than transfers or demographic factors. This is an important point.

2.2 Sectoral employment and wages

Next we look at sectoral employment (see Table 3). As we have seen, 80% of the increase in rural family income per capita came from the growth in labor income. We would now like to go behind the changes in earned income to see how much came from the growth in agricultural and non-agricultural employment and how much from a growth in average earnings. To get sectoral information for workers, we are forced to use a subset of the entire household survey because it is the only source of detailed sectoral information per earner. The problem is that it is limited to earners over the age of 14 who are in the labor force. That may impart a bias if some

[8] This is a lower bound estimate given our assumption that total transfer income was unaffected by the fall in the rural population.

[9] Note that the reduction in the labor force in the rural sector is at least partly responsible for the increase in rural wages, but we would need a model of rural labor markets to estimate how important that factor may have been.

[10] We know that the earnings contribution to total rural income growth was 80%, unearned income 20%. We also estimate that 85% of rural income growth came from earnings and only 15% from the fall in the rural population. We, therefore, estimate that earnings contributed 85% of 80 or 68% of total income growth, while unearned income contributed 0.79 × 0.20 or 16%, assuming a constant population. The reduction in the rural population directly contributed 15% of 80% plus 21% of 20% or 16%.

Table 3 Sectoral employment by location in 2004–2012

	Employment				Share of total employment		
	Primary	Secondary	Tertiary	Total	Primary	Secondary	Tertiary
2004							
Urban	1,085,943	1,179,389	6,249,241	8,514,573	0.13	0.14	0.73
Rural	2,476,882	174,502	465,945	3,117,329	0.79	0.06	0.15
Total	3,562,825	1,353,891	6,715,186	11,631,902	0.31	0.12	0.58
2012							
Urban	795,219	1,498,167	8,081,899	10,375,285	0.08	0.14	0.78
Rural	1,348,015	190,384	626,068	2,164,467	0.62	0.09	0.29
Total	2,143,235	1,688,551	8,707,967	12,539,752	0.17	0.13	0.69

Source: author's worksheets based in the INEI household surveys

In the share part of the table the rows sum to one

family members in the big household survey are family members under the age of 14 working on family farms or are retired heads of household whose income comes from pensions and transfers. This means that we cannot get a precise decomposition of the changes in Table 3. Instead we can get a pretty accurate idea of the main factors driving the big increase in the earned income component in Table 3.

The first and most important result of the analysis of the employment and income data for those over 14 for which we have sectoral information is that there is a very sharp decline in the share and the absolute numbers employed in agriculture. Agriculture comprised 79% of rural employment in 2004 but only 62%, 8 years later. There was some growth in both the share and the absolute numbers in manufacturing, but the bulk of rural job creation was clearly in the tertiary sector, particularly commerce, finance, tourism and other social services.

The data also permit one to calculate total earned income by sector for all those reporting income from which one can calculate the average wage. Note that the absolute numbers of workers for this calculation are smaller than those underlying Table 3, but are internally consistent with the wage information shown in Table 4. Wages went up in real terms across the board. But they went up faster in agriculture than in either of the other two sectors. Indeed they closed half of the rural–urban income gap over the period.

Since we also know that rural employment fell, this rise in rural wages has to be the main reason why family earnings per capita in the rural sector increased. It was not because the primary sector created more jobs. It did not. It seems that workers got pulled out of primary as urban jobs opened up. They cannot have been pushed out of the sector because that would have implied a widening of the rural–urban wage gap.

What this shows is that the increase in labor income that we noted earlier in the rural sector came mainly from a very large increase in wages. The actual employment in the primary sector fell, though that is offset by rising employment in both manufacturing and the tertiary sector. But what really makes a difference is the

Table 4 Average earned income by sector

	Primary	Secondary	Tertiary
Average earned income by sector			
2004			
Urban	12.29	21.79	19.09
Rural	10.17	13.56	18.80
Total	10.88	20.63	19.07
2012			
Urban	25.33	33.04	33.02
Rural	21.50	33.55	34.83
Total	22.92	33.10	33.15
	Primary (%)	Secondary (%)	Tertiary (%)
Yearly growth in real earnings (%)			
Urban	6.5	2.4	4.1
Rural	6.8	8.9	5.0
Total	6.7	3.2	4.2

Source: author's worksheets based on INEI surveys. Data are monthly earnings per employee

These are implicit wages = total labor income divided by total employment. The growth in real earnings in bottom panel deflate the top panels by the CPI of Peru with 2004 equal to 1.00

growth in average rural wages.[11] Overall rural employment hardly moves, but there is a shift from primary to secondary and tertiary employment. What seems to have happened was the creation of a dynamic urban economy particularly in the Sierra-Selva region where the 89% of the rural poor lived.[12] That raised income and employment in the urban areas and drew the working age population out of the rural areas of the sierra. That in turn permitted wages to rise in the rural area, particularly for workers in the manufacturing and services sub sectors.

3 Cohort analysis

In thinking about mobility, migration or poverty reduction, it is useful to do the analysis using equivalent cohorts. We are interested in tracking what happens to certain groups such as the rural population or the young. That would be relatively simple if we had a panel. But our successive surveys are not a panel so we cannot follow the same individuals over time. But we can do something which is roughly equivalent so long as our surveys are large and representative which is to follow equivalent age group cohorts over time. For example, the cohort 30–35 in 2004 is the cohort 38–43, 8 years later. The data have to be adjusted for a certain number of

[11] Note that this rise in rural earnings occurred in spite of the world-wide financial crisis which mainly affected agricultural exports from the coast.

[12] In 2004, 89% of rural poverty was in the Sierra-Selva. That rose to 92% by 2012.

Table 5 Poverty rates by equivalent cohort and rural–urban

	Ex pov	Total pov	Equivalent cohorts	
			Expov	Total pov
2004				
P0				
Urban	0.06	0.48		
Rural	0.43	0.85		
2012				
P0				
Urban	0.02	0.18	0.02	0.16
Rural	0.21	0.55	0.19	0.52

Source: author worksheets. Note that the reported poverty figures

In the LH columns use our adjusted data from table one

deaths and outmigration, especially in older cohorts, but once we have done that we can make a good estimate of rural to urban migration, mobility, and changes in poverty because the groups from successive surveys are comparable, and the estimates of poverty or migration will be for particular groups of people such as those who were in the rural sector or the Sierra in the base year (see Tables 5, 6) That will not be the same as the simple comparisons of rural poverty or poverty in the Sierra at two points in time and the differences may be instructive.[13]

There are two advantages to this procedure. First it allows us to pinpoint the cohorts with rapid rates of poverty reduction and or rural–urban migration. It also allows us to see whether or not some of the changes in reported poverty are the spurious result of change in cohort weights or whether they come from differential rates of migration or death rates. We can also use the cohort analysis to identify the impact of rural–urban migration on poverty rates in both the rural and urban sectors, since we know that if the size of each cohort is fixed then the sum of changes in location or job switching have to net to zero.

Cohort analysis is also useful for thinking about mobility and migration. Typically, when addressing the question of mobility, economists look at the poverty or income level of the same age cohort over time. They ask what happened to the average income or poverty of 25–35-year-olds in the period between two household surveys. That is not an uninteresting question, but it begs the mobility question because that age cohort is composed of different people in the later year. From the point of view of society, it is useful and interesting to know how 25–35-year-olds are faring relative to the rest of the population. But from the individual point of view, what is important is how they are faring relative to the rest of their cohort, or how their own cohort is faring over time. That is easy to see when thinking about poverty statistics. Typically, poverty rates are calculated using successive household surveys. But the people in poverty in year t in a country may not the same people who were in the poverty population in an earlier year because a large number of the

[13] Morley (1981) developed the cohort-poverty analysis formally.

Table 6 Poverty rates

Cohort	As reported		2012	
	2004	2012	Equivalent	P0
0–25	0.64	0.30	8–33	0.28
26–60	0.51	0.22	34–68	0.21
>60	0.48	0.23	>68	0.24
Total	0.57	0.26		0.24

poor are young. In most countries, the young improve their income and consumption as they get older. Many of those in poverty move out of poverty, but are replaced by a new group of the young. From the point of view of society this distinction between what happens to those who were impoverished at some point in time and those who are at the bottom of the income pyramid at different points in time may not be important. But for the poor at a point in time, the difference is crucial. What we might call the base period poor may well be getting out of poverty and moving up the consumption or income pyramid, even though the aggregate poverty indicators as generally measured do not show that.

First we split the sample into four cohort aggregates that conform to the 2004 groupings 8 years later. That is the 0–25 group is now the 8–33-year-old group, and so on. Obviously the 0–8 cohort was not in the sample in 2004 so they are excluded from these estimates. Likewise some unknown number from each cohort have died or migrated out of Peru. We then take the cohorts representing the same age groups, and disaggregate their poverty estimates by urban and rural for 2012 and show the result in Table 5 and the national result by age cohort in Table 6. The left-hand columns in both tables show the poverty rates as reported in Table 1. In the right-hand columns we have split the sample into three cohort aggregates that conform to the 2004 groupings 8 years later. If we look at just at the equivalent cohorts for the rural–urban sectors in Table 5 where we have dropped the 0–8 cohort, all the incidence figures drop a bit since poverty incidence is always highest in the youngest cohorts.

We then take the cohorts representing the same age groups, and show the national poverty rates as reported and by equivalent cohort in Table 6. The national poverty rate for those alive in 2004 and 2012 is 2.2 percentage points lower than what has been reported partly because poverty incidence is highest in the youngest cohorts and partly because there is more upward mobility among equivalent cohorts than is implied by comparing poverty by age group.

3.1 Poverty reduction and rural to urban migration

Now we are in a position to ask how much of the overall poverty reduction in Peru came from rural–urban migration in the equivalent age cohorts. In 2004, the total rural population was 7.8 million persons 85% of whom were poor. Eight years later the rural population had shrunk to 7.1 million and poverty incidence to 55%. Of those who were alive in 2004 and in the rural sector (7.4 million), only 6 million

were still in the rural sector 8 years later (see Table 9).[14] That is rural to urban migration and other demographic effects in the comparable cohorts reduced the rural population by 1.4 million persons (7.4–6.0). We can now estimate how much this reduction in the number of people reduced rural poverty using the Oaxaca–Blinder decomposition and considering only comparable cohorts.[15] When we do that, we find that the pure population effect (migration plus demographic effects) reduced rural poverty by 1.56 million, while the reduction in rural incidence in the remaining rural population reduced it by an additional 2.5 million (there is a substantial cross product term because of the length of the time period under consideration).

The point here is that if we think that the surveys of 2004 and 2012 are roughly representative, about five eighths of the overall reduction in rural poverty of those alive in 2004 came from poverty reduction in the population that stayed in the countryside, and only 3/8 from the reduction in the rural population from all causes including both death and rural–urban migration.

This is important because it says that for the most part poverty reduction in the countryside was not because people left to go to the towns and cities, but rather because incomes rose for those who remained. This point will be supported by the mobility analysis presented below.

4 Mobility matrices

The equivalent cohort data we have assembled can be used to construct some useful mobility matrices that will show the movement of population between the rural and urban sectors and between the Sierra-Selva and the coast. For each of our four cohorts, we subdivided our sample by rural–urban and by region (Sierra-Selva and Coast). Since we already know the rate at which each cohort declines due to death, outmigration from Peru and sampling error, we can make a very good estimate of the movement of each cohort across the four cells into which we have divided the country. We are going to call the resulting table a mobility matrix.

Since the four categories probably have a substantial income overlap, these matrices are not exactly the same as the usual mobility matrix. What they do represent is the transition of the Peruvian population from the lowest average income subcomponent—the rural Sierra-Selva to the highest—the coastal urban subcomponent. That being the case one can think of upward mobility being represented by the entries in the upper right off diagonal elements of the matrix and downward mobility by the lower left off-diagonals (see Table 7).

We show the matrices for all four cohorts and the national total in Table 7. For the row and column sums for each sub-category and for each bold diagonal entry we know the original population in 2004 and the observed population in 2012. The

[14] Table 8 gives the data on which the decomposition is based.

[15] See Oaxaca (1973) and Blinder (1973). Any observed change in income can be rewritten as the change in average earnings at the original population level plus the change in population at the original earnings level plus the changes in population times the changes in earnings.

Table 7 Rural–urban mobility matrix

	ss rural	Coast rural	ss-urban	Coast urban	Total
For 0–25-year-olds in 2004					
ss rural	**2,936,960**	0	552,479	0	*3,489,439*
Coast rural	0	**391,906**	259,753	51,221	*702,880*
Sierra urban	0	0	**3,128,370**	0	*3,128,370*
Coast urban	0	0	0	**7,112,561**	*7,112,561*
Total	*2,936,960*	*391,906*	*3,940,602*	*7,163,782*	14,433,250
For 26–40-year-olds in 2004					
ss rural	**979,103**	0	9,925	0	*989,028*
Coast rural	0	**152,179**	175,072	0	*327,250*
Sierra urban	0	0	**993,709**	0	*993,709*
Coast urban	0	0	379,015	**3,217,444**	*3,596,459*
Total	*979,103*	*152,179*	*1,557,720*	*3,217,444*	5,906,446
For 41–60-year-olds in 2004					
ss rural	**949,353**	0	82,598	0	*1,031,951*
Coast rural	0	**125,038**	102,855	0	*227,893*
Sierra urban	0	0	**1,036,687**	0	*1,036,687*
Coast urban	0	0	146,341	**3,011,906**	*3,158,247*
Total	*949,353*	*125,038*	*1,368,482*	*3,011,906*	5,454,779
For +60-year-olds in 2004					
ss rural	**436,574**	0	71,692	0	*508,266*
Coast rural		**53,440**	24,619	14,915	*92,974*
Sierra urban	0	0	**451,227**	0	*451,227*
Coast urban	0	0	0	**1,095,551**	*1,095,551*
Total	*436,574*	*53,440*	*547,538*	*1,110,466*	2,148,018
National					
ss rural	**5,301,990**	0	716,694	0	*6,018,684*
Coast rural	0	**722,563**	562,299	66,136	*1,350,997*
Sierra urban	0	0	**5,609,994**	0	*5,609,994*
Coast urban	0	0	525,356	**14,437,462**	*14,962,818*
Total	*5,301,990*	*722,563*	*7,414,343*	*14,503,598*	27,942,493

Source: author's worksheet

ss refers to Sierra-Selva region. Note also these are the survivors from 2004 in the survey of 2012. They are directly comparable to Table 8. Note also that the totals in each row are the 2004 population while the column totals show where this same population was in 2012

column sums in the table are the observed totals for each component in 2012, and the row sums are the observed totals in 2004. The bold diagonal entries are an estimate of the members of the original cell who were still in that cell 8 years later. Thus, for example, we see that in 2004 there were about 3.5 million 0–25-year-olds in the rural Sierra-Selva. If there was no net migration to the rural Sierra-Selva, 2.9

million were still there 8 years later, which means that about 550,000 of the original group must have moved to one of the other three cells.

To help understand how these matrices were developed, consider the rural coast for the 0–25-year-old age group. Since it lost almost half of its population, we set all its inflow columns at zero. Next consider the urban coast. Overall its population was almost constant between 2004 and 2012. Since the urban sierra was the one area with a large population inflow, we set the outflow from the urban sierra to the rural coast at zero. That means that all the net increase in the urban coast (51,000) had to have come from the rural coast.[16] But, by simple subtraction that determines the flow from the rural coast to the urban sierra (260,000). That in turn determines the residual flow from the rural to the urban sierra (552,000). The other age cohort matrices were developed in a similar manner.

Look now at the evidence. There are several patterns in the national table to note here. The first is the tremendous attractive force of the urban Sierra-Selva area. It started the period with a population of 5.6 million and ended with 7.4 million. It drew many of those from the rural areas of the region, but many also came from the coast, both rural and urban because there simply were not enough migrants from within the sierra to match the observed increase in the urban population.

Another pattern is the predominance of the young in the rural–urban migration flow within the sierra and the role of older migrants from the coast. Altogether some 717,000 out of the 1.8 million increase in the urban population of the Sierra came from the rural Sierra. Of those, 77% were in the 0–25-year age group. Most of these must have been young people coming with their families from the rural areas surrounding the urban centers of the Sierra-Selva. Conversely, the coastal area supplied almost 1.1 million migrants to the population of the urban Sierra.[17] 74% of those were between 25 and 60. Many must have been in the labor force responding to rising employment opportunities in the urban Sierra.

Finally there is little or no evidence of net migration (of the 2004 population) to the urban areas of the coast. Indeed there is some outmigration from the urban coast to the Sierra. This is a surprising result but not necessarily inconsistent with the notion of rapid urban growth at the coast. Recall that what we have here is equivalent cohorts which means that they exclude the 0–8-year-old age group of 2012, many of which must be on the coast. But barring sampling error, outmigration or differential death rates, regional migration favored the urban Sierra-Selva over all other regions of the country.

4.1 A rural–urban poverty mobility matrix

The population movements between the rural and urban sectors can be combined with our poverty by equivalent cohorts data to generate a second set of mobility matrices that give us an estimate of the transition of the 2004 population by their

[16] Remember that these figures are net which means that we assume no "churning"—that is no outflow of migrants from the cell and replacement by an inflow from another cell.

[17] 562,300 + 525,356 = 1,087,000.

place of origin and 2004 poverty status. The household surveys give us the distribution of the 2004 and 2012 populations by equivalent cohort and their rural or urban location. We also know the distribution of each equivalent cohort's poverty rates for 2004 and 2012. Since we also know from Table 9 how many of the each 2004 cohort moved from the rural to the urban sector, we can estimate the number of people who moved from each cell to each other cell of an expanded mobility matrix.[18] We construct such a matrix for our four equivalent cohorts and show the result in Table 8. The *ij*th row in the matrix shows the number of people in the *i*th row in 2004 who move to column j in 2012. Thus, for example, in the 0–25-year age cohort, the top left-hand entry shows the number of people who were classified as rural poor in 2004 and remained in the rural poor group in 2012. As in Table 7, each row sum is the observed number of poor or non-people by rural and urban in 2004 while the column sums show the 2012 sums for the same categories. Note that the estimates have to be consistent with Table 7 and with the observed urban and rural poverty indices by equivalent cohort for 2004 and 2012.

It is worthwhile to stop for a moment to understand how the matrix was constructed and what it tells us. Take the matrix for the 0–25 cohort (it is the 8–33 cohort of 2012). In 2004, there were 4.2 million 0–25s in the rural sector.[19] 89% of them were poor.[20] (3.7/(3.7 + 0.474). We also know from the later survey that there were only 3.3 million still in the rural sector in 2012, of which 1.8 million were poor.[21] If we assume that none of the rural non-poor of 2004 became poor (i.e., no net downward mobility) then we know the diagonal entry in row two (474,000). Since we know the overall rural population of 2012, and the poverty rate, we know the total number in the rural sector who were not poor in 2012 (1.5 million). Since we assume no net downward mobility, the number of the rural poor of 2004 who escaped from poverty but remained in the rural sector is 1.052 million (1.526 million–0.474 million). Now the sum of the rural to urban migration for the rural poor of 2004 is determined. It is 863,000.[22] We can now set the fraction of those who joined the urban poor such that the overall observed urban poverty rate for the equivalent cohort for 2012 is consistent with what was observed in the household survey. Obviously this procedure depends on our assumption that there is no net downward mobility in either the rural or urban sectors. That is what permits us to put zeros in the relevant cells of the matrix and calculate the rest of the entries in the matrix such that the totals are consistent with the observed poverty levels in 2012.

With all this as an explanation of how the poverty mobility matrices were constructed, what can we learn about rural poverty reduction in Peru? First, looking at the national totals in Table 8, we see that there was tremendous progress made in

[18] The data do not permit us to make a confident estimate of a mobility matrix including poverty and the coast-Sierra disaggregation. However, recall that 89% of rural poverty in 2004 was in the Sierra-Selva regions, so what happens to national rural poverty is likely to be reflective of the mobility of the rural poor in the Sierra-Selva.

[19] 3.7 million plus 0.47 million.

[20] This percentage comes from the household surveys.

[21] This is the total rural population in 2012 (1.8 million plus 1.5 million).

[22] 0.15 million plus 0.71 million.

Table 8 Rural–urban poverty mobility matrix

Poverty mobility matrix by rural–urban					
	Rural poor	Rural non-poor	Urban poor	Urban np	Total
0–25					
Rural poor	**1,802,798**	1,051,787	150,000	713,453	*3,718,038*
Rural non-poor	0	**474,281**	0	0	*474,281*
Urban poor	0	0	**1,789,064**	3,790,907	*5,579,971*
Urban np	0	0	0	**4,660,961**	*4,660,961*
Total	*1,802,798*	*1,526,068*	*1,939,064*	*9,165,321*	14,433,250
26–40					
Rural poor	**590,092**	314,726	40,000	144,997	*1,089,815*
Rural non-poor	0	**226,463**	0	0	*226,463*
Urban poor	0	0	**744,290**	1,363,400	*2,107,690*
Urban np	0	0	0	**2,482,478**	*2,482,478*
Total	*590,092*	*541,189*	*784,290*	*3,990,875*	5,906,446
41–60					
Rural poor	**483,834**	349,922	22,000	163,453	*1,019,209*
Rural non-poor	0	**240,636**	0	0	*240,636*
Urban poor	0		**500,754**	1,131,524	*1,632,278*
Urban np	0			**2,562,656**	*2,562,656*
Total	*483,834*	*590,557*	*522,754*	*3,857,633*	5,454,779
≥61					
Rural poor	**262,353**	105,554	18,000	93,226	*479,133*
Rural non-poor	0	**122,107**	0	0	*122,107*
Urban poor	0		**241,532**	307,702	*549,233*
Urban np	0		0	**997,545**	*997,545*
Total	*262,353*	*227,661*	*259,532*	*1,398,472*	2,148,018
National					
Rural poor	**3,139,077**	1,821,989	230,000	1,115,129	*6,306,195*
Rural non-poor	0	**1,063,486**	0	0	*1,063,486*
Urban poor	0	0	**3,275,640**	6,593,532	*9,869,172*
Urban np	0	0	0	**10,703,640**	*10,703,640*
Total	*3,139,077*	*2,885,475*	*3,505,640*	*18,412,301*	27,942,493

Source: author worksheets. Italicized numbers are observed in the surveys. Note that these are the survivors from 2004 in the survey of 2012. They are directly comparable to Table 6. The totals in each row are the 2004 population while the column totals show where this same population was in 2012

rural poverty reduction among those who were poor in 2004. That is true in both the rural and urban sectors. There were 6.3 million rural poor in 2004. 46% of them or almost three million got out of poverty over the period.[23]

[23] 1.8 million plus 1.1 million.

Second, it is instructive that 1.8 million or 62% of the group that got out of poverty stayed in the rural sector. In other words, almost two thirds of rural poverty reduction was due to increases in rural family income not rural–urban migration. If you were poor in 2004, you did not have to move to town to get out of poverty. This is consistent with the Oaxaca decomposition discussed earlier. Third, among the rural poor, it was the young who migrated—64% of total rural–urban migration of the poor came from the 0–25 cohort even though it comprised less than 60% of the rural poverty population in 2004.[24]

4.2 Who migrates?

We can say more about the age characteristics of those who migrate from the rural to the urban sector. Since we have a sample and not a census, we cannot expect that the observed cohorts will be identical. But they should be close and indeed they are, except for the oldest cohort where deaths significantly reduce the size of the cohort in 2012.[25] To make the two populations exactly equal, we adjust the observed 2012 cohort figures by the percentage difference between the expected and the actual populations of 2012. We then apply the adjustment factors to the observed rural and urban populations separately. This means that we assume that the sampling error is the same in the urban and the rural sectors or equivalently we assume the same death rates and weighting errors in the urban and the rural sector. With that we have the following breakdown of rural to urban migration by the age cohorts of 2004 (see Table 9). Note that the totals add up to the observed rural and urban populations of 2012 as adjusted by the death rates. Note also that we identify the cohorts by their ages in 2004. Thus, the cohort 0–25 in 2004 is the cohort aged 9–33 in 2012. The implication of this adjustment procedure is that we can now distribute across the rural and urban sectors the 2004 population which was still alive in 2012.

The main point of this exercise will be to show that the great majority of rural to urban migration between 2004 and 2012 has to have been in the age cohort 0–25 in 2004. They comprise 64% of the total rural to urban migration between 2004 and 2012. It is the young who migrate. Since the young typically have higher than average poverty rates, this by itself will tend to pull down rural poverty rates. It also means that gradually the share of the young in the rural population will decline.

Not only can we show that it is the young who migrate. We can also show that it is the better educated among the young who migrate. In Table 10, we show the proportion of the rural population in the two young cohorts of 2004 with either complete or incomplete primary or secondary education and the education levels of those same cohorts in the rural sector 8 years later. In 2004, in the 16–25-year-old rural cohort 42% had primary school or less and 51% had at least some high school. Eight years later, of those in the rural sector in that same cohort the primary school share had grown to 49% while the high school share had fallen to 40%. The only

[24] That is $(150 + 713)/(230 + 1115) = 0.64$.

[25] The differences are small. For the 0–25 cohort, the actual population is 0.98 of the expected, for 26–4 it is 0.93, for the cohort 41–60 it is 0.96 and for the 60+ it is 0.76.

Table 9 Equivalent cohort population by location in 2004 and 2012

Equivalent cohort population by location in 2004				Observed location in 2012		Rural–urban migration	Migrant share
2004 cohort	Rural	Urban	Total	Rural	Urban		
0–25	4,192,318	10,240,932	14,433,250	3,328,866	11,104,384	863,453	0.64
26–40	1,316,278	4,590,167	5,906,445	1,131,281	4,775,164	184,996	0.14
41–60	1,259,845	4,194,934	5,454,779	1,074,391	4,380,388	185,453	0.14
60+	601,240	1,546,778	2,148,018	490,014	1,658,004	111,226	0.08
total	7,369,681	20,572,811	27,942,492	6,024,553	21,917,939	1,345,128	1.00

Source: author's worksheet based on INEI household surveys. Note that the 2012 population is adjusted by the observed survival rates by cohort

Table 10 Percentage of rural with primary and secondary education

Cohort		Percentage of rural with primary and secondary education			
2004	2012	Primary		Secondary	
		2004	2012	2004	2012
16–25	24–33	0.42	0.49	0.51	0.40
26–40	34–48	0.65	0.70	0.28	0.25

Source: author's worksheet

way that could happen is if the better educated in each cohort migrated, raising the cohort share of the less educated left behind in the rural sector.

If we put this evidence together with the education data from Table 10, one can guess that the better educated young rural parents brought their families to town to give them better educational opportunities. The resulting outflow of workers from the rural sector might then have raised the wages and incomes of those who were left behind, permitting the reductions in rural poverty that we observed in Tables 5 and 6. If our conjecture here is accurate, more attention should be paid to educational migration as a promising way to reduce rural poverty rate, even among those who remain in the rural sector.

The reason that the progress in rural poverty reduction is not more obvious in the published statistics is that the rural 0–25 cohort of 2004 is replaced by a new 0–25 cohort in 2012 and it contains a new 0–8 age group with a 36% poverty rate. In other words, from the point of view of Peruvian society, observed rural poverty does not fall nearly as fast as it does for the group of people who were poor in a particular year. The reason is that there is a constant replacement at the bottom of the income pyramid by a new group of the young, and that group continues to have relatively high rates of poverty. When one looks at equivalent cohorts instead of certain age groups, the difference is clear. For example, if you were young, poor and in the rural

sector in 2004, there was a 47% chance that you would escape from poverty over the next 8 years.[26] If you were in the 26–40 age group of the rural poor in 2004, you had a 42% chance of becoming non-poor in 2012. Even if these probabilities are not as large as they were for the urban sector, they still indicate a very substantial amount of poverty reduction and upward mobility in the rural sector. Politically, the sort of improvement in the prospects of the poor that can be found by looking at equivalent cohorts may be more important than the continuation of high levels of measured poverty and inequality.

5 Conclusions

What we found in Peru was a very dynamic, growing economy successfully increasing income per capita across the board. Most of the gains flowed to the urban sector, but the growth was rapid enough to draw a lot of the rural population out of the rural sector to higher paying opportunities in the urban sector. Most of that rural to urban migration appears to have been within the Sierra-Selva not from the highlands to the coast. The result was dramatic upward mobility for the rural poor of our base year 2004. Using our equivalent cohorts approach we were able to show that for those who were young and in the rural sector in 2004, even though their poverty rate was 89% in that year, 47% got out of poverty over the next 8 years. Thus, high reported rates of rural poverty could and did exist along with rapid upward mobility for the poor of a particular year. That mobility is obscured by young new entrants whose poverty remained relatively high.

We disaggregated the changes in rural income per capita to better understand the sources of the rapid gains enjoyed by the rural population. The data clearly show that most of the gains came from rising earnings, rather than specific poverty targeted transfer programs or the growth of agriculture. Altogether 80% of the change in rural income came from increased earnings. When we dug deeper we were able to show that most of the remaining 20% came from a substantial reduction in the number of dependents per rural worker. That added about 15% to reported rural income per capita. Outmigration from the rural sector which was large, only directly accounted for 4% of the overall growth in rural incomes. It was not so much that there were fewer rural workers. It is that the reduction in the labor force raised the wages for those who chose to remain the rural sector.

This increase in rural earnings was not led by agriculture. It was mainly because of a general rise in wages across industrial and services activities within the rural population, coupled with a massive movement of the better educated from the rural to the urban areas of the Sierra and Selva. Better educated workers and their families particularly young families were pulled out of the rural areas and the rapid overall growth rate of the economy permitted an increase in average wages both in the urban receiving areas and for the smaller labor force left behind in the rural sector. The general rise in wages extended from the urban to all the activities in the rural areas, not just those in agriculture. Thus, Peru looks more like a case of "a rising

[26] (1051 + 713)/3718.

tide lifts all boats" than a case of successful specific poverty reduction interventions. These patterns are likely to continue to be true, particularly given the difficult natural conditions of agriculture in the Sierra and the relatively small amount of arable land available there.

Peru shows that even a growth strategy and investments in education which mainly benefitted the urban sector helped the rural poor as well. Maintaining rapid growth along with continued improvements in education is probably the most effective anti-poverty program that could be implemented. A decade of rapid overall growth and educational migration did more to reduce rural poverty than targeted poverty programs. Peru invested heavily in education in the Sierra and Selva. What that did was to permit the better educated young to move to adjoining urban areas where the mobility data show a quite dramatic move out of poverty by those rural–urban migrants as well as those who remained in the rural area.

It is also important to devise better metrics to measure progress, Simple statistics or comparisons of poverty rates over time are misleading and understate the real progress that has been made. Following given groups of people over time using panels or alternatively equivalent cohorts or mobility matrices gives a more complete picture of the dramatic changes that are taking place.

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